

# String 18 Operating Instructions

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**Version 1.1**  
**November 12, 2001**

## **Look for updated versions of this document at**

[http://rust.lbl.gov/~jacobsen/docs/operation\\_of\\_digital\\_string.pdf](http://rust.lbl.gov/~jacobsen/docs/operation_of_digital_string.pdf) and  
[http://rust.lbl.gov/~jacobsen/docs/operation\\_of\\_digital\\_string.doc](http://rust.lbl.gov/~jacobsen/docs/operation_of_digital_string.doc)

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### **Things to be added to this document**

- Explanation of Ethernet power switch at Pole
- Mouse plugging/unplugging issue
- How to control high voltage
- How to operate flashers
- How to upload a new application to the DOM
- How to upload new firmware into the DOM
- How to check the status of the device driver
- How to watch the device driver in progress and check for errors
- What to do if the DOMs are not communicating
- How to configure a database of DOMs
- How to take periodic data with domlogger

## Introductory Information

### Contact Information for John Jacobsen

(in case you get into trouble and need to contact someone while there is a satellite connection to/from South Pole):

John's LBNL phone: +1 510 486 5871

John's home phone: +1 510 839 5491

John's cell Phone: +1 510 325 8858

John's e-mail pager: pageme@johnj.com (1-2 lines of text only)

### Summary of Document

This document covers the operation of the new String 18 DAQ hardware and software, to be installed at the South Pole in December, 2001. String 18 is a series of Digital Optical Modules (DOMs) installed in 2000 as part of the AMANDA neutrino detector. The DOMs are prototypes of a sensor to be used for the IceCube experiment.

The document is laid out in such a way that it should be easy to find out how to do a specific task by looking in the Table of Contents.

### String 18 Software Principles

The software consists of several parts running on different machines. At the lowest level, DOMCOM boards (formerly, "Test Boards") send and receive communications with the DOMs. These boards are contained in 5 DOMCOM PCs (tbdaq-1 through tbdaq-5), with eight DOMCOM boards per PC.

Each DOM is made available to the network by a device driver ("tb") which controls the DOMCOM boards, and some networking software ("dataserver" and "syncserver") running on each PC. Control software, running on a PC such as fireball or string18, allows one to control the DOMs (set high voltage, record data, etc.).

The DOMs run in two modes: "boot mode" and "application mode." In boot mode, one can communicate with the DOMs using a simple, text-based communication protocol (similar to telnet, or dialing a modem by hand). One can upload applications or DOM firmware to the DOM when it is in boot mode. In application mode, one has access to the normal range of operating functions.

The current control programs are as follows:

**domcom:** allows one to load FPGA firmware on DOMCOM board, and control power to DOMs

**domtalk:** allows one to communicate with the DOM just after booting

**domprobe:** look for the presence of a running DOM application

**domhv:** measure or set HV on a set of DOMs (each running in application mode)

**domtest:** configure database of DOMs, interactively exercise various DOM functions

A database created by domtest is required for domhv or domlogger

**domlogger:** take data over a long time period with the DOMs

Each of these programs, typed at the Linux command prompt followed by "-h" (for example, "domprobe -h"), will print out a small help message that will give hints as to how it can be used.

Most of the control programs can be used from any of the String 18 PCs (fireball, string18, tbdaq-\*). However, the programs requiring a database (domhv, domlogger) should all be used from a standard location (currently fireball, although this may change before Feb. '02). This way you can be sure you are using the correct database.

## Overview of Operation Requirements

In order to set PMT voltages on the DOMs, or take data from them, the following conditions must be met.

1. DOMCOM PCs configured and installed, and DOMs cabled to DOMCOM boards in the PCs
2. DOMCOM PCs accessible over the network
3. Control PCs (fireball and string18) up and accessible over the network
4. syncserver, dataserver and “tb” driver installed in each DOMCOM PC
5. DOMCOM FPGAs loaded
6. DOM power on
7. Application running in the DOM
8. FPGA loaded in the DOM

If all these requirements are met, one should be able to talk to each DOM using the full messaging protocol, set voltages, etc.

## Miscellaneous Tips

Lines beginning with “%” are to be typed at the Linux terminal prompt.

About numbering schemes: the DOMCOM control PCs are numbered from 1 to 5; the DOMCOM boards in each PC are numbered from 0 to 7. The DOM IDs are numbered with numbers > 1000 (except in DOMBoot, where the numbers have the 1000 offset subtracted off).

## Notes and Instructions for doing various things

See the table of contents, above, if you’re interested in doing a particular thing.

### Networking the DOMCOM PCs:

The PCs are configured with DHCP. The MAC addresses of each PC should be given to the Pole networking people, along with their names. They will put this information into their host tables. In this way, when you plug the machines into the network, they should automatically be configured and accessible from the outside.

Use the “ping” to test the networking. I.e., when logged into fireball, “ping tbdaq-1” should give something like:

```
PING tbdaq-1.spole.gov (128.3.32.63) from 128.3.32.30 : 56(84) bytes of data.  
64 bytes from tbdaq-1.spole.gov (128.3.32.63): icmp_seq=0 ttl=255 time=409 usec  
64 bytes from tbdaq-1.spole.gov (128.3.32.63): icmp_seq=1 ttl=255 time=394 usec  
64 bytes from tbdaq-1.spole.gov (128.3.32.63): icmp_seq=2 ttl=255 time=377 usec
```

### To log into one of the String 18 PCs:

The PCs in question are:

```
fireball  
string18  
tbdaq-1 through tbdaq-5
```

In each case, you may have to append .spole.gov or .usap.gov to reach these machines.

To log in,  
% ssh dom@fireball.spole.gov  
You'll need to know the password.

To log in locally, attach a monitor, keyboard and mouse. Log in as dom. If you want a windowing display,  
% startx

However, you may have problems with mouse functionality if the system has booted without a mouse attached. In that case, you may have to reboot the system.

### **To reboot or shut down one of the String 18 PCs:**

Log in as user "dom".  
Become superuser with "su"  
% shutdown -r now

To power off the machine, substitute "-h" for "-r".

**Please do not power cycle a Linux machine without shutting it down first!** This can cause problems with the Linux file system.

### **To list the available FPGA files on a DOMCOM PC:**

Log in to fireball or string18. If you want to see the files available on tbdaq-1:  
% domcom tbdaq-1 0 list  
(The number 0 is arbitrary here, as the test board is irrelevant for the list operation.)

### **To load one of the FPGAs on a DOMCOM board:**

Log in to fireball or string18.  
If the appropriate FPGA file is domcom.jam, the DOMCOM PC is tbdaq-1 and DOMCOM board ID is 0:  
% domcom tbdaq-1 0 load domcom.jam

### **To cycle the power on one of the DOMs:**

Example for PC 1, board 0:  
Log onto fireball as "dom".  
% domcom tbdaq-1 0 reboot  
You may want to connect to the DOM using domtalk in a separate window at the same time, to make sure the DOM does indeed reboot.  
Note: DOM power is on by default.

### **To turn power off one of the DOMs:**

Example for PC 1, board 0:  
Log onto fireball as "dom".  
% domcom tbdaq-1 0 off  
Substitute "on" for "off" to turn it back on.

### **To interact with the same DOM in boot mode:**

% domtalk tbdaq-1 0  
Hit return to get a boot prompt.  
A timeout occurs after power-up, after which the DOM application is automatically booted, so you may have to power-cycle the DOM to get the boot prompt.  
**To quit domtalk**, type the escape sequence ("Control-]") and hit q.

**To list FPGA files and DOM applications in a given DOM:**

Get the DOM into boot mode. You can see a list of applications and FPGA programs by typing “l” at the prompt. This shows all the files in the flash file system. Application files are labeled as such in the “File Type” field. The default application is currently “dom\_app\_2001”.

**To start the DOM application:**

Get the DOM into boot mode. The “B” command allows you to boot an application. For example (user text is in bold):

```
Domboot 1.16 DOM 45 Enter command (? for menu): B
Enter the name of the application to start:
dom_app_2001
Copying dom_app_2001 from flash to SRAM...
Rebooting...
```

After booting the application, you won’t be able to interact with DOMBoot anymore (i.e., if you connect with domtalk, typing return won’t give you a prompt). To exit domtalk, type the escape sequence (“Control-]”) and hit q.

**To test that the DOM application is running, and show status of FPGA in DOM:**

Example: from fireball, testing for DOM on DOMCOM PC 1, board ID 0:

```
% domprobe tbdaq-1 0
```

```
Got a good DOM (1045), attached to DOMCOM PC tbdaq-1, port 4000.
```

```
DOM 1045 at tbdaq-1:4000 : FPGA status -> LOADED
```

```
Major version number: 0
```

```
Minor version number: 4
```

```
Board ID: 0
```

```
FPGA ID: 1
```

```
FPGA file name: DOM 1
```

Please note that after boot-up, it takes a few minutes for the application to automatically load the FPGA (assuming the correct preferences are set in domboot).